Water Injection Systems Solutions

Solutions from front-end concept to complete turnkey supply
For more than 30 years, Schlumberger has been a leader in designing turnkey water injection systems. Our experience extends from offshore to onshore applications, including fixed structures and floating production facilities. The portfolio of solutions is extensive, covering collective expertise in a variety of operating environments and water types, including ocean, river, aquifer, and produced water for reinjection.

Water management for oil and gas production and processing is challenging. High-quality, cost-effective, reliable, and environmentally responsible water solutions are mandatory to continued success in the global operating environment.

With an emphasis on technology, research, and development, Schlumberger continues to develop technologies that reduce weight and space as well as provide performance improvements and reductions in both operating costs and capital expenditures. Schlumberger provides the engineering, site, and operating support to manage water in oil and gas operations around the world.
Typical water injection system.

Filtration process

- Operating pressures, bar: 15–80, 5–25, 1–5, 1, < 1

- Particulate range size, um: Ions 0.001, Molecules 0.01, Macromolecules 0.1, Small particles 1, Sand particles 1,000

- Applications: Solubles, Viruses, Bacteria, Algae and protozoa, Pesticides, Albumin, Oil emulsions, Metal ions, Colloids, Oil emulsions

- Visibility: Electron microscope, Optical microscope, Human eye

Filtration spectrum.
BFCC system
The BFCC* copper chlorine system is a highly efficient, compact copper chlorine generator for the prevention of settlement and growth of biological organisms in water systems.

- No moving parts
- No hydrogen tank required
- Low capex and opex
- No additional chemicals needed
- Low power and maintenance requirements
- Compact unit size

METROL SEA-CELL electrochlorinator
METROL SEA-CELL* electrochlorinators generate hypochlorite from seawater through an in situ electric process. Hypochlorite—one of the most effective oxidizing biocides in use today—is used to prevent life growth of all living organisms.

- Approved by British Approval Service for Electrical Equipment in Flammable Atmospheres (BASEEFA) for use in areas requiring a certified electrical apparatus
- Does not require acid treatment to maintain efficiency
- Can be operated up to 100% of rated output through the use of phase-angle-controlled thyristor rectifiers
- Unique configuration eliminates the requirement for secondary enclosures commonly used in other designs

METROL SEA-SCREEN strainer
On offshore platforms where space and weight are important, the METROL SEA-SCREEN* coarse strainer offers more efficient filtration per unit area compared with competing units.

- Robust, high-efficiency unit with a long and proven pedigree
- Removal of silt, plankton, algae, and 98% of particles larger than 100 um
- Use of spool assembly that incorporates tubular wedge-wire elements, held between two plates and housed within a pressure vessel
- Automatic or manual backwashing
- Minimized backwash water volumes required

Media filters
With no internal moving parts and minimal maintenance, Schlumberger media filters are designed to treat water with low operating costs, making them suitable for injection for secondary recovery.

- Capable of removing 98% of particles larger than 2 um
- Proprietary internals are specifically designed to evenly distribute and collect water over the entire cross-section of the filter bed
- No loss of efficiency during severe conditions when solids loadings are particularly high, such as during bloom periods
- Designed to uphold your specified filtered water quality by ensuring a consistent media quality
- The system is cleaned by utilizing a backwash initiated either by a timer or by a preset pressure drop across the media bed
**Sulfate removal systems**

The Schlumberger portfolio of NATCO* separation technology includes sulfate removal systems that are designed to remove divalent sulfate ions from seawater to the required level for injection.

The sulfate removal system can be used in two main areas—reservoir scale control, where the presence of certain salts (e.g., barium and strontium) in the formations, in conjunction with the sulfate present in seawater, combine to form scale in the reservoir, and souring control, where sulfate-reducing bacteria present in the formation consume the sulfate in the seawater and produce damaging, corrosive hydrogen sulfide as a by-product.

The sulfate removal systems come with a clean-in-place system for better membrane cleaning. The membranes are packaged in individual fiberglass-reinforced-polymer (FRP) housings and are placed in racks in a two-stage 2:1 configuration depending on the required flow. A total of 75% of the inlet flow is produced as a low-sulfate product stream.

- Used in conjunction with other technologies, such as the Polymem UF system, design fluxes can be optimized to reduce the quantity of membranes and capex.
- The sulfate removal membrane systems can be customized to meet unique project requirements.
- Our complete range of technologies enables a full system process guarantee rather than only for individual equipment items.

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**Polymem UF system**

Schlumberger is the exclusive provider of Polymem® ultrafiltration (UF) system to the oil and gas industry. Polymem SA, France, developed and manufactures the UF membrane elements.

- Significant reduction in operating weight compared with traditional media and cartridge filters
- High-quality treated water for injection or membrane separation is virtually independent of varying feedwater quality
- Utilizes a 0.01-um filtration threshold that retains not only inorganic (mineral) particles but also bacteria and viruses
- Chlorine tolerance, enabling the use of conventional prechlorination for control of biofouling
- Allows a reduction in quantity of downstream reverse osmosis (RO), nanofiltration (NF), and sulfate reduction (SR) membranes
- Requires only simple maintenance procedures, such as reduced frequency of cleaning and replacement of RO, NF, and SR membranes
- No need for additional consumable cartridge filters
- Compact packaging within custom-made modules
**Vacuum and gas strip deaerators**

Our VDX* vacuum-stripping de-aeration system and GDX* gas-stripping de-aeration system remove dissolved oxygen from the feedwater before it is injected into the reservoir. The systems

- prevent corrosion of downstream plant and equipment and inhibit aerobic bacterial growth
- feature corrosion-resistant tower internals to maximize mass transfer and give effective distribution and redistribution of the liquid phase
- can be used on floating production, storage, and offloading (FPSO) vessels, where motion is an important factor in the design of towers and internals
- provide solutions where height and center of gravity are not major issues, as is often the case on large floating installations
- achieve levels of oxygen down to 50 ppb, so any additional removal of oxygen to 20 ppb will require the addition of some oxygen-scavenging chemical.

**CDX compact deoxygenation system**

The Schlumberger CDX* compact deoxygenation system enables removing oxygen from seawater in a footprint that is up to 40% smaller and 60% lighter compared with conventional systems. In addition to removing oxygen from seawater to levels that are suitable for reservoir injection, the system

- fits between decks
- reduces space and weight compared with conventional technologies
- decreases structural steel requirements because of dynamic motion and bending moments
- reduces site installation requirements
- minimizes or eliminates oxygen scavenger requirement
- eliminates dynamic motion performance issues and antifoam requirement
- potentially eliminates pump requirement.
Reverse osmosis systems
Schlumberger designs and builds desalination systems with RO membrane technology. Membrane systems are becoming an industry standard as customers seek cost-effective, reliable, and environmentally acceptable solutions.

Our RO system removes a significant amount of the dissolved ionic species from the seawater. The process is similar to sulfate removal, though only 50% of the inlet flow is produced as low-salinity product. The process can be used in a number of ways to improve your performance:
- enhance oil recovery by injecting low-salinity water into the reservoir
- achieve a blended product that satisfies both salinity and divalent salt criteria by using an SR system with RO technology
- improve performance of desalters
- provide potable water
- reduce the need for chemicals and biocides by reducing consumption of washwater and postconditioning to a pH level to avoid naphthenate scaling.

Chemical injection packages
For all components of the water injection system to operate effectively, various chemicals need to be introduced at alternate points in the system. Schlumberger offers a range of chemical packages to suit customer specifications:
- antifoams, oxygen scavengers, scale inhibitors, corrosion inhibitors, and biocides
- filter aids that encourage very small particles to form larger particles, which are more easily captured in the media
- antiscalants for injection into the feed of SR or RO membrane systems to prevent mineral scale from forming within the membranes as salts become concentrated
- cleaning chemicals used on an intermittent basis to clean the UF, NF, and RO membrane systems
- integrated production chemical technologies and services to help maximize recovery safely and reliably, regardless of system complexity or geography.

Schlumberger water injection services
We provide the industry’s largest services network and infrastructure, the most service locations worldwide, highly trained OEM technicians, and technology solutions that deliver new levels of efficiency and cost savings.

Strategically located across the globe, we provide support from installation and commissioning through operations and maintenance, spare and replacement parts, technical training, and process equipment audits and upgrades. Schlumberger has the people, products, and technologies to provide the highest-quality support in achieving production targets.